Adolfo M. García, *The Neurocognition of Translation and Interpreting*, Amsterdam: John Benjamins, 2019, xx, 268pp.

Since the beginning of Translation and Interpreting Studies (TIS), multiple disciplines have been involved into the field, making it "a house of many rooms" (Neubert and Shreve, 1992). As process-oriented TIS started to attract increasing attention, researchers began to employ concepts, methods and tools from psychology, psycholinguistics and cognitive science to explore the "black-box" of translation. It was not until recently that cognitive neuroscience has been a source of inspiration for translation and interpreting (T&I) researchers. The stated aim of *The Neuroscience of Translation and Interpreting* is to introduce neurocognitive research into the study of interlingual reformulation (IR), and to examine and interpret "neuropsychological, neuroscientific, and behavioural evidence on highly prominent topics for TIS" (5). Although researchers in the area of cognitive TIS are its main intended audience, this book also seeks to address the T&I community in general as well as the fields of bilingualism and neurolinguistics. The author, Adolfo García, who has a background in TIS, linguistics and neuroscience, explains how the process of T&I can be boldly and innovatively investigated using methods from cognitive neuroscience.

A comprehensive account of brain-based study on T&I, the book under review basically follows a structure of an empirical research report. Chapter 1 raises research questions; Chapter 2 and 3 address research methods and fundamental research principles; Chapter 4-7 present evidence and results from previous studies, discussing their merits and limitations within these studies; and Chapter 8 provides the author's tentative answers to the research questions, and outlines his understanding of the role of neurocognitive IR research in future TIS.

Basing his account on the emergence and development of cognitive TIS since the 1960s, the author first raises six research questions that have not been adequately addressed with non-neural approaches. These questions mainly concern the distinct mental operations caused by translation directionalities, translation units, and competence and expertise in T&I. Neural approaches, borrowed from other disciplines, provide a new perspective to investigate these questions, something which "constitutes an addition, an extension, a complement to the various non-neural approaches" (40).

The methodological toolkit applied to neurocognitive IR research is then introduced in Chapter 2, including the lesion model, non-invasive techniques (e.g., fMRI, PET, EEG, ERP) and invasive techniques (e.g., direct electrostimulation and intracranial recordings). Several principles relating to stimuli construction, lesion model interpretation, and device constraints are explained to help neurocognitive IR researchers choose the most appropriate method for specific research questions, and interpret the results in a comprehensive and unbiased way. Chapter 3, which could be skipped by experienced researchers in neuroscience of language, provides a good review of the fundamentals of neurology, the neural organisation of language, and the neurocognitive aspects of bilingualism. The basic notions explained in these two chapters serves as valuable guidance for readers, especially novice researchers in this area, to understand the basic principles of experimental design, evaluate the research introduced in Chapters 4-7, and prepare for conducting future neurocognitive IR research.

From Chapter 4-7, the author elaborates on neural-based research that provides evidence to answer the research questions raised in Chapter 1. In Chapter 4, four types of IR disorders reported in neuropathological studies are identified, which shed light on the dominant role of left hemisphere (LH) in IR process, the semi-independence of IR pathways from single-language pathways, the independent mechanisms recruited in different translation directions, and the distinguishable reliance on the conceptual-level and form-level routes in IR. However,

evidence from these cases are rather limited and biased, since most cases only involve injuries in LH but not in right hemisphere (RH). The underrepresentation of RH injury cases fails to exclude the relevance or engagement of RH in the IR process and thus casts doubt on the author's claim about the lateralisation of IR. Also, the independence of different translation direction routes seems arguable based on these lesion cases. It remains unknown whether the dissociation between the functioning of two translation direction routes is caused by the deficiency in specific receptive or productive skills of a single-language pathway, or by the dysfunction of the IR pathway in a specific direction. This chapter concludes with two neuro-anatomical models of translation and (simultaneous) interpreting (125, 127), which do not explore the underlying neurocognitive activities. In other words, these models are really only at a preliminary stage and merit further verification with other neurocognitive methods.

Further to the evidence from lesion-based studies, studies using neuroimaging, electrophysiological, and/or psycholinguistic methods also demonstrate the specificity of different translation directions, i.e., "backward translation (BT, from L2 to L1)", and "forward translation (FT, from L1 to L2)" (3). It is worth noting that the paired terms (BT & FT) widely used in cognitive neuroscience, are actually unfamiliar to and somewhat misleading in TIS. BT (named under the numeric logic - from L2 back to L1) which is traditionally regarded as the default and only natural way of T&I (Pokorn 2011), however, indicates the sense of unnatural, under-developed and reverse by the semantic meaning of "backward". By contrast, FT (L1 to L2) which is alternatively named by T&I scholars as "inverse/reverse translation" or "retour" (in interpreting) and treated as "unnatural and non-native" practice (Newmark 1981:180), initiates a certain confusion due to the onward and progressive meaning implied by "forward". Although directionality study in TIS has been briefly reviewed in section 5.1, this book would benefit if the terminological inconsistency existing in the two different disciplines was clarified. As for the content, these brain-based

studies reveal differences between BT and FT in the engagement of the subcortical and cortical hubs, the inter-regional connections, the time course of the underlying processes of IR, and behavioural performance. Compared to FT, BT requires greater cognitive effort in source-segment processing but less effort in lexical retrieval and selection. This is partially compatible with Tymoczko's (2012) claim that source text comprehension is unconsciously shaped by culture, making it difficult for translators to perceive "culturally unnatural" items (Tymoczko 2012, 90) in their L2 during BT. The evidence for the so-called "directionality effect" challenges some previous non-neural research findings which refute the "directionality effect" on the IR process (150) and calls into question the validity of non-directional translation models (151). Directionality studies introduced in Chapter 5 also contribute to interpreting the rather coarse-grained concept of cognitive effort that has been widely discussed in cognitive TIS with more specific and precise terms. In non-neural research, "cognitive effort" has often been measured through behavioural manifestations (e.g., reaction time, ocular movement) which do not necessarily reflect the effect of the independent variables (e.g., directionality). Through neural approaches, "cognitive effort" could be decomposed into more precise factors, including working memory and inhibitory function. This part of Chapter 5 (138-140) is somewhat difficult to follow, since some studies are introduced rather briefly, with terms and concepts that are neither straightforward for a novice nor explained in the context.

Another outstanding aspect that might influence the distinctive neural mechanism recruited is the linguistic properties of source text segment. Chapter 6 presents consistent evidence for the differences between word translation and sentence translation, and between different types of words in terms of the sub-serving neural regions and the time courses of the neurocognitive operations. Based on these evidences, the author challenges translation models that neutralise the translation unit or refer to an omnipresent unit. Instead, he

proposes a unit-sensitive model which also includes the semantic- and form-level features of SL items. Such a unit-sensitive model overcomes the under-specification of unit-blind models and embraces a more detailed description of the IR process. Nonetheless, the attempt to encompass all linguistic properties of SL items into a translation model will undoubtedly increase its complexity. Another interesting argument, based on an ERP research finding (165 -167), is that the IR process is (at least) partly organised by the bilingual brain, rather than exclusively by the T&I pathways (175). Other findings concerning the shared bilingual lexico-semantic system from some neural and psychological studies (Diamond and Shreve 2010; Shreve and Diamond 2016) support this argument and conceive this system as the neural foundation sub-serving all the inter-lingual activities of a bilingual. It is thus safe to assume that an improved bilingual system may enhance the IR process, and lead to higher T&I proficiency.

Nonetheless, the evidence presented in previous chapters does not show whether repeated T&I practices could induce changes or even improvements in the IR process and the bilingual brain in reverse. The author answers this question by introducing the "interpreter advantage hypothesis" (178) in Chapter 7. Reports based on longitudinal studies indicate that sustained simultaneous interpreting training can result in significant changes in the anatomical and functional aspects of the brain. A comparison is made between professional simultaneous interpreters and non-interpreter multilinguals. In general, professional simultaneous interpreters demonstrate advantages in interpreting-related linguistic and executive functions (e.g., auditory perception, lexical retrieval, and working memory span), but not in some fundamental attentional functions and inhibitory functions. This is also in line with Moser-Mercer's (2010) survey findings that repeated performance of interpreting tasks helps build and activate efficient lexical and concept retrieval and accelerates semantic analysis and reasoning during interpreting. Whereas long-term memory (LTM) has been

explicitly highlighted as a crucial role in (developmental) interpreting by Moser-Mercer (2010), it is not among the major focuses in this chapter. Instead, the importance of LTM in interpreting is reflected through the introduction of vocabulary and lexico-semantic processing which inevitably involve access to LTM.

The author concludes the book in Chapter 8 with his answers to the six questions put forward in Chapter 1, and with a summary of the major accomplishments and deficiencies of the current neurocognitive TIS. From his review of scientific and institutional initiatives, the author claims that neurocognitive TIS represents a major trend for future TIS.

Overall, this book demonstrates how brain-based research approaches in TIS offer new insights into what goes on in the translator/interpreter's brain and extend translation process research from cognitive and behavioural investigation to cognitive neuroscientific exploration. Opening up a new frontier of research, the author invites readers to "step into the attic" (1) by providing a wealth of theoretical frameworks, concepts, models, toolkits, and empirical evidence. At the same time, it responds to the recent call for a dialogue between cognitive neurosciences and translation studies (Shreve and Diamond 2016) and successfully crosses the borders by synthesising two seemingly distant disciplines into a new and exciting field of research. Finally, García ambitiously aims to reverse the general perception of the neuroscience of translation as a "known unknown" area of TS (Tymoczko 2012, 83), and succeeds in making the unknown known. This book is thus an essential read for scholars who are interested in studying the real 'black box' of T&I, using tools and methods from cognitive neuroscience, and for researchers in the fields of bilingualism and neurolinguistics who wish to explore the novel and distinctive tasks involved in cross-language processing.

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